

INFLUENCE OF BACKUP BEARINGS AND SUPPORT STRUCTURE 42613  
DYNAMICS ON THE BEHAVIOR OF ROTORS WITH ACTIVE SUPPORTS 5P

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## Progress to Date

This report documents the progress that has been made in the proposed research work since the first annual report. Substantial progress has been made toward fulfilling the goals of year two. Specific accomplishments for the past six months are itemized below.

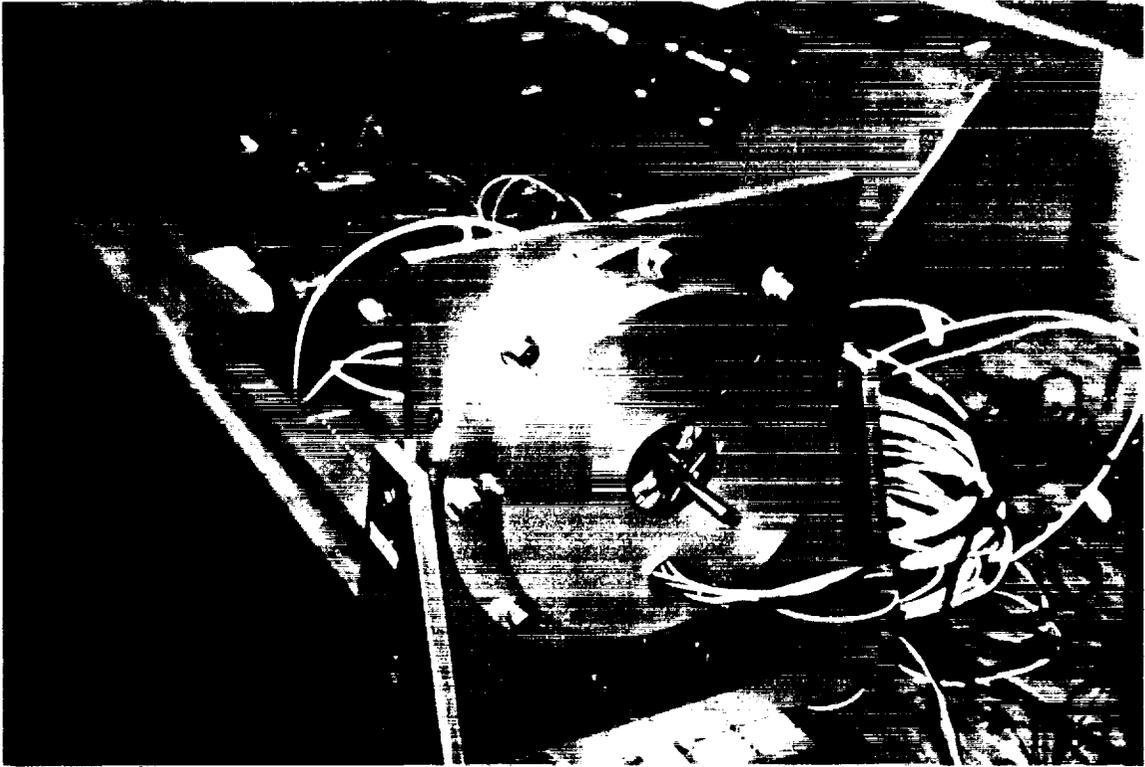
1. A paper has been presented that documents the work using the T-501 engine model. The paper was presented at the *Symposium on Nonlinear and Stochastic Dynamics*, held at the *1994 ASME Winter Annual Meeting*, November 13-18, 1994, Chicago, Illinois. The paper has also been submitted to the *ASME Journal of Vibration and Acoustics*.
2. A paper that discusses some of the work using the T-501 engine model has been presented at the *First Industry/University Symposium on High Speed Civil Transport Vehicles*, December 4-6, 1994, Greensboro, North Carolina. A copy of the paper is included in the Appendix.
3. Development of the experimental facilities has continued. This includes a new design for the magnetic bearing (shown in Figure 1) and the inclusion of housing dynamics in an additional test rig (shown in Figure 2).
4. A paper that documents an experimental/simulation study of auxiliary bearing rotordynamics has been accepted for presentation at the *40<sup>th</sup> ASME International Gas Turbine and Aeroengine Conference*, June 5-8, 1995, Houston, Texas. A copy of the paper is included in the Appendix.
5. A paper that describes a rotordynamical model for a magnetic bearing supported rotor system, including auxiliary bearing effects has been written and submitted to the *ASME 15th Biennial Conference on Vibration and Sound*, to be held in Boston, Massachusetts, Sept. 17-21, 1995. A copy of the paper is included in the Appendix.
6. A finite element model for a foil bearing has been developed. Rotordynamical studies of a rotor supported by foil bearings is currently underway.
7. Additional studies of rotor/bearing/housing dynamics are currently being performed with the experimental rig and simulation models.
8. The effects of sideloads on auxiliary bearing rotordynamics is being studied using the magnetic bearing supported rotor model.

## Bibliography

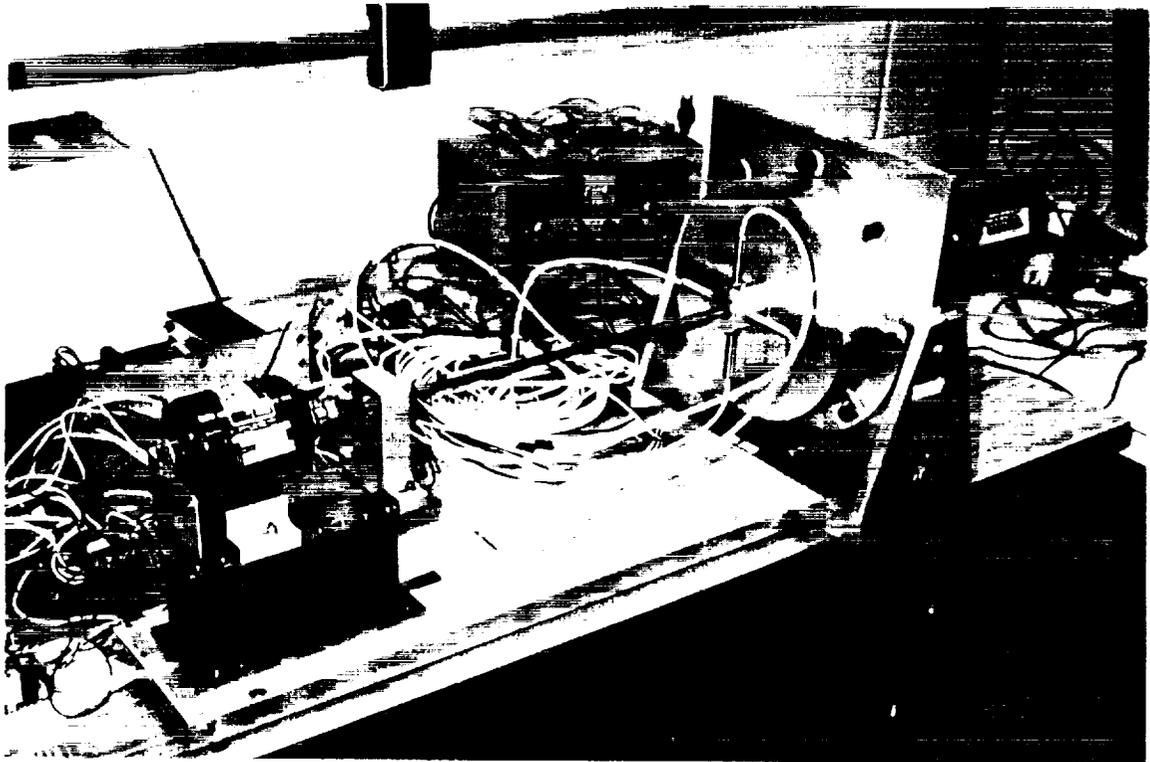
1. Flowers, G.T., Xie, Huajun, and Lawrence, C. "Steady-State Dynamic Behavior of an

Auxiliary Bearing Supported Rotor System," presented at the *Symposium on Nonlinear and Stochastic Dynamics*, held at the *1994 ASME Winter Annual Meeting*, November 13-18, 1994, Chicago, Illinois.

2. Flowers, G.T., Xie, H., and Sinha, S.C., "Dynamic Behavior of a Magnetic Bearing Supported Jet Engine Rotor with Auxiliary Bearings," presented at the *First Industry/University Symposium on High Speed Civil Transport Vehicles*, Greensboro, North Carolina, December 4-6, 1994.
3. Lawen, James L., Jr., and Flowers, George T., "Synchronous Dynamics of a Coupled Shaft/Bearing/Housing System With Auxiliary Support From a Clearance Bearing: Analysis and Experiment," accepted for presentation at the *40<sup>th</sup> ASME International Gas Turbine and Aeroengine Conference*, June 5-8, 1995.
4. Free, A., Flowers, George T., and Trent, Victor S., "Dynamic Modelling of a Magnetic Bearing Rotor System Including Auxiliary Bearings," submitted to the *ASME 15th Biennial Conference on Vibration and Noise*, Sept. 17-21, 1995, Boston, Massachusetts.



**Figure 1.a: Magnetic Bearing Supported Rotor Test Rig (Front View)**



**Figure 1.b: Magnetic Bearing Supported Rotor Test Rig (Side View)**

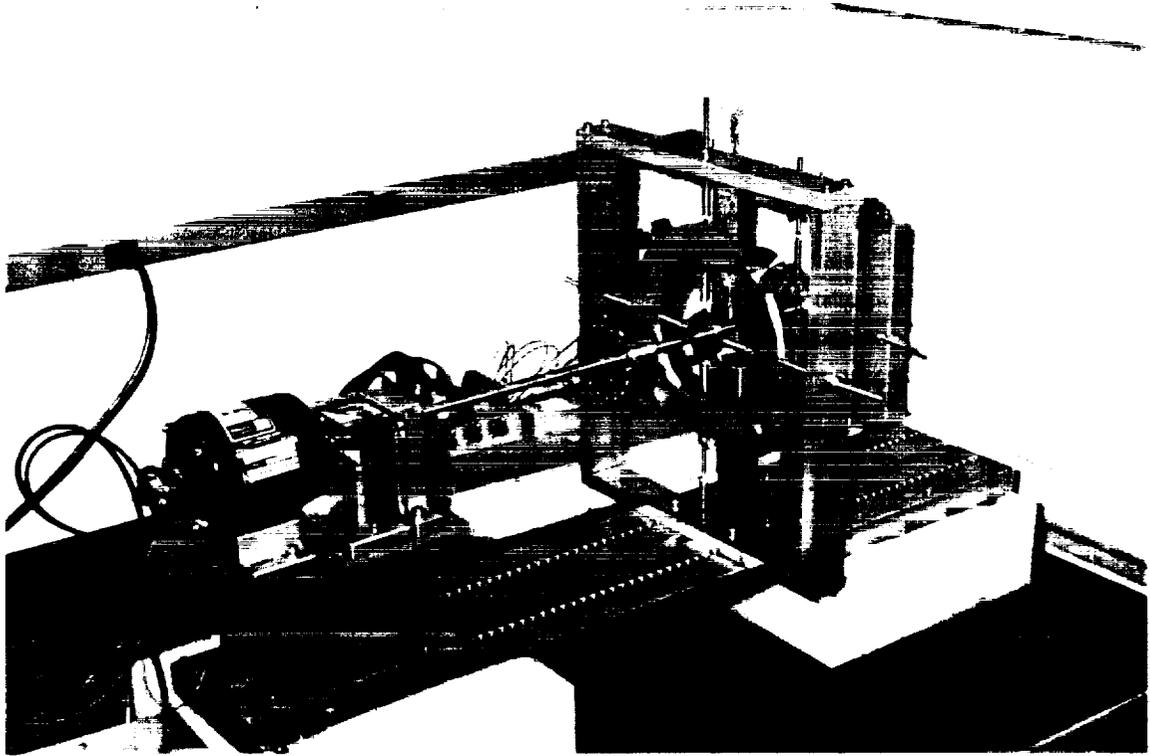


Figure 2.a: Shaft/Bearing/Housing Rotordynamics Test Rig

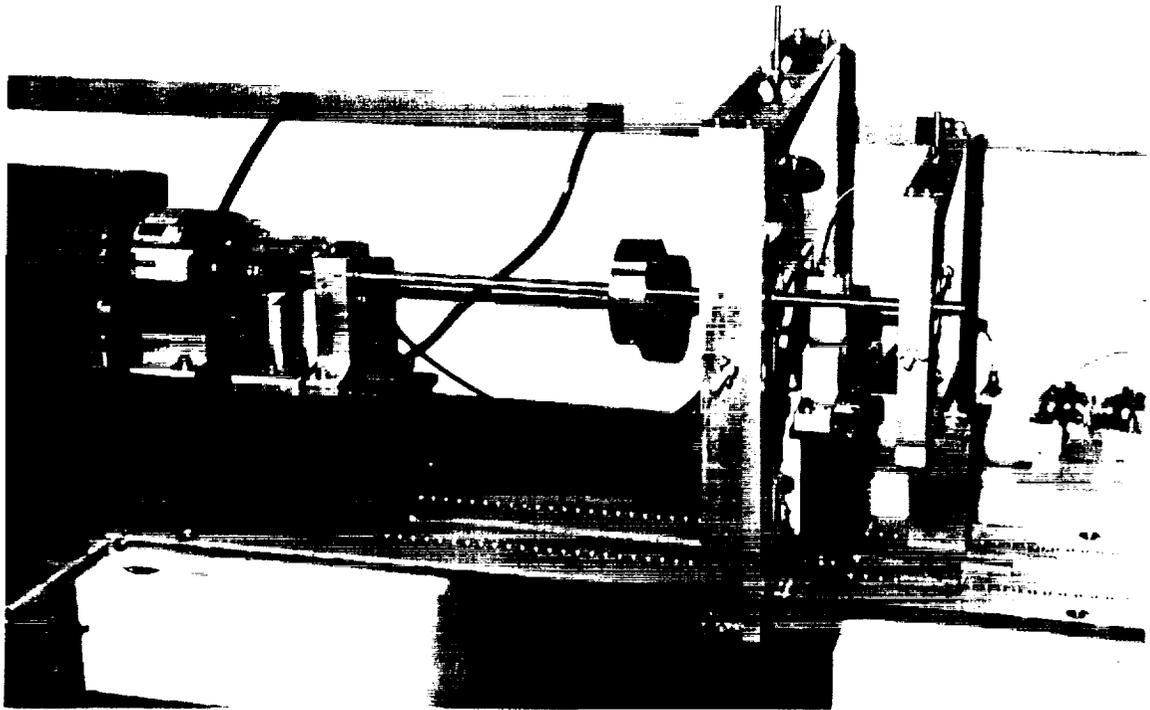


Figure 2.b: Shaft/Bearing/Housing Rotordynamics Test Rig (Side View)